

Missouri Department of Natural Resources

Total Maximum Daily Load Information Sheet

Village Creek

Water body Segment at a Glance:

County: Madison
Nearby Cities: Fredericktown
Pollutant: Inorganic Sediment and Lead
Source: Mine La Motte
Abandoned Mine Lands

Water Body ID (WBID)
and Stream Lengths: 2863 – 1.5 miles
2864 – 3.0 miles



State map showing location of watershed

TMDL Priority Ranking: TMDL Approved by EPA on Jan. 14, 2010

Scheduled for TMDL Development: 2009

Description of the Problem

Beneficial Uses of Village Creek (both segments):

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life
- Protection of Human Health (Fish Consumption)
- Whole Body Contact Recreation – Category B

Use that is impaired

- Protection of Warm Water Aquatic Life

Standards that apply

Missouri has no numeric standard for inorganic sediment. Excessive deposits of sediment in waters of the state are interpreted as violations of the general criteria of the Water Quality Standards. The Missouri Water Quality Standards for general criteria [10 CSR 20-7.031(3)] states that:

- (A) Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses;
- (C) Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses;
- (D) Waters shall be free from substances or conditions in sufficient amounts to result in toxicity to human, animal or aquatic life;

Missouri WQS for metals found in 10 CSR 20-7.031(4)(B)1 state:

Water contaminants shall not cause the criteria in Tables A and B to be exceeded.
Concentrations of these substances in bottom sediments or waters shall not harm benthic organisms and shall not accumulate through the food chain in harmful concentrations, nor shall state and federal maximum fish tissue levels for fish consumption be exceeded.

Table A of the Water Quality Standards contains dissolved lead criteria for the protection of aquatic life designated use. These criteria are hardness dependent and calculated from the formulas shown below:

Dissolved Lead (DPb)

Acute = $e^{(1.273 \cdot \ln(\text{hardness}) - 1.460448)} \cdot (1.46203 - (\ln(\text{hardness}) \cdot 0.145712)) = \mu\text{g/L}$ (micrograms per liter)

Chronic = $e^{(1.273 \cdot \ln(\text{hardness}) - 4.704797)} \cdot (1.46203 - (\ln(\text{hardness}) \cdot 0.145712)) = \mu\text{g/L}$

Analysis of the dissolved lead data indicated that only the chronic dissolved lead criterion was exceeded and that no excursions were observed for the acute dissolved lead criterion. Therefore, only the chronic dissolved lead criterion will be used for this Total Maximum Daily Load (TMDL).

Background Information and Water Quality Data

The inorganic sediment pollutant replaces previous 303(d) listings of non-volatile suspended solids. Since non-volatile suspended solids and inorganic sediment have essentially the same meaning, the listing was changed to inorganic sediment to better characterize the impairment, but the two terms may be used interchangeably. The data used to identify the pollutant has not changed. Inorganic sediments are mineral particles such as clay, silt, sand or assorted sized pieces of rock or other non-organic materials. These particles usually enter streams via erosion of soils or other materials from the surface of the land. Visual observation of Village Creek over the past 15 years by the Missouri Department of Natural Resources (the Department) has shown instream deposition of mine tailings due to erosion from a mine tailings pile adjacent to the creek. The sediment added to the creek is harmful to aquatic life because it covers the streambed resulting in the reduction of spawning habitat for fish and the smothering of fish eggs and small aquatic organisms. Additionally, the mine tailings carry lead into the stream causing exceedances of the consensus based Threshold Effect Concentration of toxicity for some aquatic organisms¹. The Threshold Effect Concentration is the level of metal contamination below which adverse effects on the aquatic biota are not expected to occur. The source of the impairment has been identified as the Mine La Motte abandoned mine lands.

The Mine La Motte tailings area consists of approximately 495 acres that are currently owned by the Mine La Motte Recreation area, of which approximately 250 acres are covered with tailings. The area is contained within a region of southeast Missouri commonly referred to as the "Old Lead Belt." It is the oldest lead mining area west of the Mississippi River with its first operations dating back to 1720. Lead mined from the Mine La Motte area has been used to manufacture ammunition for every military action of the United States from the American Revolution to the Korean conflict.

¹ MacDonald, D.D., Ingersoll, C.G. and Berger, T.A. 2000. Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems. Arch. Environ. Contam. Toxicol. 39, 20-31

The area was of such vital strategic importance during the Civil War that following the Battle of Fredericktown, Union forces destroyed the furnaces at Mine La Motte rather than allow its lead-producing capabilities fall into Confederate hands.

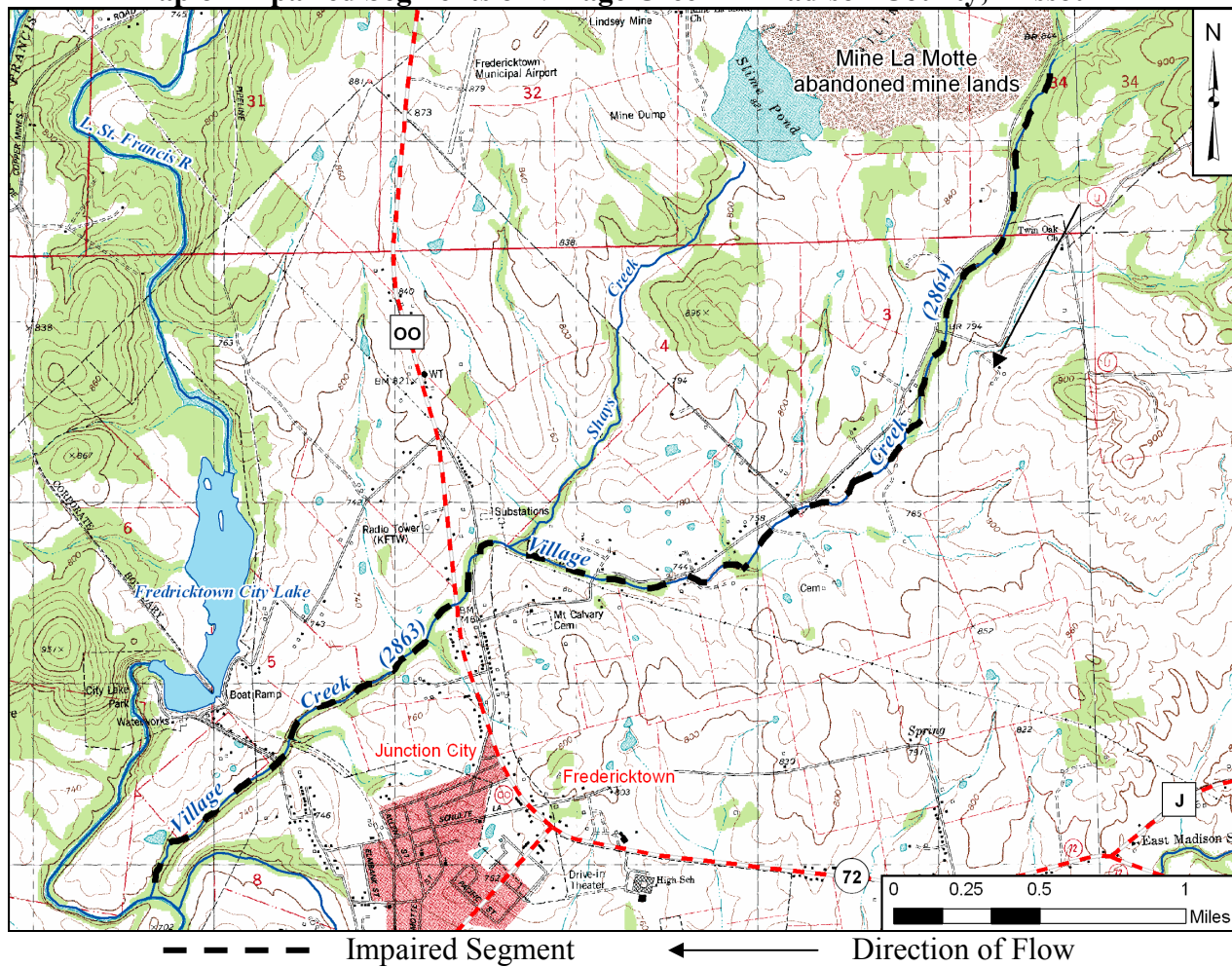
In 2003, these abandoned mine lands were added to the National Priority List as part of the Madison County Mines Superfund Site making them eligible for future remediation and cleanup following further investigation and study. Superfund is a federal government program to clean uncontrolled hazardous waste sites. The Madison County Mines site has been broken down into six Operable Units. Each Operable Unit consists of tailings and mine areas specific to different sections of the Madison County Mines site. Mine La Motte tailings is in Operable Unit-1 and is located in the northeast quarter of Madison County.

In April 2000, the U.S. Environmental Protection Agency, or EPA, analyzed sediment samples from Village Creek for heavy metals contamination. In 2003 and 2006, the Department also analyzed sediment samples for heavy metals. The results are summarized in Table 1. In addition to the data in Table 1, in February 2000, EPA collected samples of tailings for lead analysis from the Harmony Lake Tailings piles, the Mine La Motte tailings pile, the Basler tailings piles and the Old Jack mine, all located within the region of Village Creek. The results of these samples indicated the tailings from Mine La Motte contained lead ranging from 490 to 3,970 mg/kg or parts per million, ppm. These samples exceed the residential “action level” of 400 ppm set by EPA, as well as the TEC noted in Table 1.

Table 1: Concentrations of Heavy Metals in the Sediments of Village Creek near Fredericktown, MO and Recommended Maximum Safe Levels for Aquatic Life (mg/kg)

Sample Location	Arsenic	Cadmium	Copper	Nickel	Lead	Zinc
EPA Superfund data WBID 2863 (SD3) April 2000	57	0.23	--	--	139	66
EPA Superfund data WBID 2864 (SD7) April 2000	66	0.34	--	--	108	65
EPA Superfund data WBID 2864 (SD9) April 2000	5	0.18	--	--	403	11
EPA Superfund data WBID 2864 (SD10) April 2000	11	0.15	--	--	139	62
Department data Village Creek (mg/kg) in 2003	32.4	0.06	15.9	22.5	104	39.3
Department data Village Creek (mg/kg) in 2006	18.2	0.34	32.2	35.3	223	63
Threshold Effect Concentration (mg/kg)	9.79	0.99	31.6	22.7	35.8	121

Map of Impaired Segments of Village Creek in Madison County, Missouri



For more information call or write:

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NOTE: The U.S. Environmental Protection Agency approved this TMDL on Jan. 14, 2010